layer covers the remaining zinc-based plating layer including the end face thereof, thereby further enhancing corrosion resistance.

Thus it is an object of the present invention is to provide a method for manufacturing a spark plug capable of efficiently forming a zinc plating layer on an integrated assembly of a metallic shell and a ground electrode excluding a free-end portion of the ground electrode.

It is a further object of the present invention is to provide a spark plug manufactured by the method, particularly a spark plug which is less likely to involve poor welding of a chip of a high melting point metal to the free-end portion to thereby avoid the potentiality of separation of the chip from the ground electrode.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a longitudinal, half-sectional view showing a spark plug according to an embodiment of the present invention;

Figure 2 is a longitudinal fragmentary view in full section showing essential portions of the spark plug of Figure 1;

Figure 3 is a schematic view showing a barrel-type electrolytic galvanization apparatus;

Figure 4 is a schematic view showing a barrel-type chromate treatment apparatus;

Figure 5 is a schematic view showing an apparatus for removing a zinc plating layer;

Figure 6A is a schematic view showing a zinc layer on a base metal according to the process of the present invention;

Figure 6B is a schematic view showing a portion of the zinc layer removed from the base metal according to the process of the present invention;

Figure 6C is a schematic view showing a chromate layer on a zinc layer on the base metal according to the process of the present invention;

Figure 6D is a schematic view showing a chromate layer and a zinc layer having an end face without chromate on a base metal prepared by a conventional (prior art) process for forming a zinc-chromate layer;

Figure 7A is a schematic view showing the first step in a process for forming a spark portion on a ground electrode through resistance welding;

Figure 7B is a schematic view showing the second step in a process for forming a spark portion on a ground electrode through resistance welding;

Figure 7C is a schematic view showing setting of an analysis line;

Figure 8 is a graph showing definition of the thickness of a diffusion layer; and

Figure 9A is a diagram showing ray analysis profiles obtained through EPMA to test sample 6 in order to measure the thickness of a diffusion layer; and

Figure 9B is a diagram showing ray analysis profiles obtained through EPMA to test sample 1 in order to measure the thickness of a diffusion layer.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will next be described in detail with reference to the drawings.

Figures 1 and 2 shown an embodiment of a spark plug 100 according to the present invention. The spark plug 100 includes a cylindrical metallic shell 1; an insulator 2 which is fitted into the metallic shell 1 such that an end portion 21 projects from the metallic shell 1; a center electrode 3 which is disposed within the insulator 2 such that a spark portion 31 of a high melting point metal formed at an end thereof projects from the insulator 2; and a ground electrode 4, one end of which is joined to the metallic shell 1 through, for example, welding, and the other end portion of which is bent such that a side surface thereof faces an end portion of the center electrode 3. A spark portion 32 of a Pt-based metal (a kind of a spark portion of a high melting point metal) is formed on the ground electrode 4 in such a manner as to face the spark portion 31 of a high melting point metal, thereby defining a spark discharge gap g therebetween.

Herein, the expression "spark portion" refers to a portion of a member welded to the ground or center electrode which is free from alteration in composition caused by welding (a portion of the member which is not alloyed with